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Applications

- 5V to 3.3V translation in mixed-supply environment
- Hot-swap interface
- Logic replacement
- Bus isolation

General Description

The VS3245 and VS32245 are high-speed TTL–compatible 8-bit bus switches. The VS3245 contains eight high-speed bus switches, with a common active low enable (/OE). The low ON resistance of the VS3245 allows inputs to be connected to outputs, without adding propagation delay and without generating additional signal noise. The VS32245 has 25Ω resistors in series with the switches to reduce ground-bounce noise and signal reflection.

The VS3245 and VS32245 bus switches are function and pinout compatible with QS3245 and CBT3245 switches. They enable 5V to 3.3V translation when used with a diode in the power supply line. In addition, the high off-isolation in the 'disable' mode makes VS3245 and VS32245 ideal interface elements for hot-swap applications.

Features

- Enhanced N-FET with no DC path to V_{CC} or GND in normal operating signal voltage range.
- Low impedance bidirectional data flow: 5Ω (VS3245) and 25Ω (VS32245)
- Pin-compatible with QS3245 and CBT3245 switches.
- Near-zero propagation delay
- Zero added ground bounce or signal noise
- TTL-compatible control signals
- Undershoot clamp diodes on all switch and control pins
- ESD rating >2000V (Human Body Model) or >200V (Machine Model)
- Latch-up current >100mA
- Available in 150-mil wide QSOP package

Figure 1. Functional Block Diagram

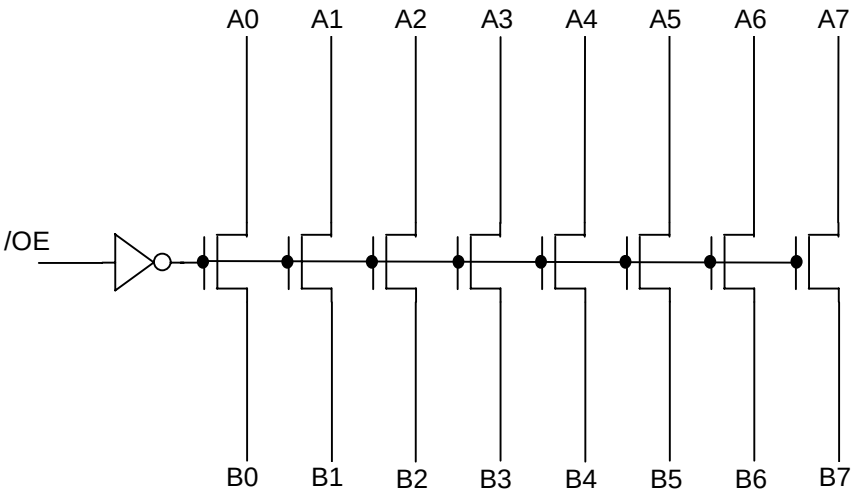

Figure 2. Pin Configuration

(All Pins Top View)

QSOP

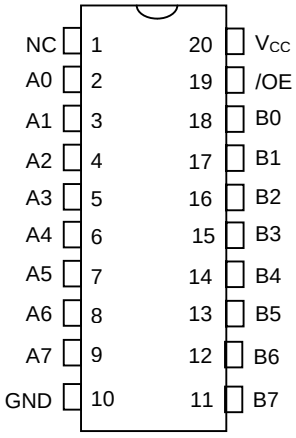

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Table 1. Pin Description

Name	I/O	Description
A_0 - A_7	I/O	Data Input or Output
/OE	I	Enable Input
B_0 – B_7	I/O	Data Output or Input

Table 2. Function Table

Input /OE	Path	Function
H	Hi Impedance	Disable all switches
L	A_n <-> B_n	$A_n = B_n$

Table 3. Absolute Maximum Ratings

Supply Voltage to Ground……..-0.5V to +7.0V
DC Switch Voltage V_S…….-0.5V to +7.0V
DC Input Voltage V_{IN}…… ...-0.5V to +7.0V
AC Input Voltage (Pulse Width < 20ns)……..-3.0V
DC Output Sink Current per Switch Pin……..…..120 mA
Maximum Power Dissipation……..0.5 Watts
Storage Temperature……...-65°C to +150°C

Note ABSOLUTE MAXIMUM CONTINUOUS RATINGS are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Correct functional operation while operating in the absolute maximum rated conditions is not implied.

Table 4. Capacitance

$T_A = 25°C$, f = 1 MHz, V_{IN} = 0V, V_{OUT} = 0V

Pins	QSOP Typ	QSOP Max	Unit
Control Inputs	4	5	pF
VSwitch Channels (Switch OFF)	5	7	pF

Note Capacitance is guaranteed, but not production tested. Total capacitance of a path, when the switch is closed, is the sum of the switch terminal capacitances.

Table 5. Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{CC}	Power supply voltage		4.5		5.5	V
V_{IL}	Low level input voltage		-0.5		0.8	V
V_{IH}	High level input voltage		2.0		5.5	V
T_A	Operating free-air temperature		-40		85	^oC

Table 6. Electrical Characteristics Over Recommended Operating Free-air Temperature Range

Symbol	Parameter	Test Conditions			Min	Typ[1]	Max	Units
V_{IK}	Clamp Voltage	Control Input	V_{CC} = Min, I_{IK} = -18 mA				-1.5	V
		Switch I/O					-1.5	
V_{OH}	Logic High Voltage	Switch I/O	V_{IN} = V_{CC} = 5V, I_{OUT} = -5µA		3.7	3.9	4.1	V
			V_{CC} = 4.3V, V_N = 5V, I_{OUT} = -5µA		3.0	3.3	3.6	
I_I	Input Leakage Current	Control Input	V_{CC} = Max, V_I = V_{CC} or GND				1	µA
$\|I_{OFF}\|$	Power OFF Leakage Current	Control Input	V_{CC} = 0, V_I or V_O = V_{CC} or GND				1	µA
		Switch I/O						
$\|I_{OZ}\|$	OFF State Leakage Current	Switch I/O	V_{CC} = Max, $V_{I/O}$ = V_{CC}, /OE = V_{CC}				1	µA
I_{ODL}	Switch I/O Drive Current (Logic LOW)	V_{CC} = Min, V_{IN} = 0, V_{OUT} = 0.4V		VS3245	50			mA
				VS32245				mA
I_{ODH}	Switch I/O Drive Current (Logic HIGH)	V_{CC} = Min, V_{IN} = V_{CC}, V_{OUT} = 2.4V		VS3245	-50			mA
				VS32245				mA
R_{ON}	Switch ON Resistance[2]	V_{CC} = Min, V_{IN} = 0, I_{OUT} = 30mA		VS3245		5	7	Ω
				VS32245	20	28	40	Ω

Notes:
1. Typical values are specified at V_{CC} = 5.0V and T_A = 25°C.
2. R_{ON} is measured by forcing specified current into the 'output' node of the switch with the 'input' node of the switch at the the specified voltage

Table 7. Power Supply Characteristics Over Recommended Operating Free-air Temperature Range

Symbol	Parameter	Test Conditions [1]	Max	Units
I_{CCQ}	Quiescent Power Supply Current	V_{CC} = Max, /OE = V_{CC} or GND, f = 0	1	µA
ΔI_{CC}	Power Supply Current per Input High (Control Input) [2]	V_{CC} = Max, V_{IN} = 3.4V, f = 0	1.5	mA
Q_{CCD}	Dynamic Power Supply Current [3]	V_{CC} = Max, Switch pins open, Control Inputs toggling at 50% duty cycle	0.25	mA/MHz

Notes:
1. For conditions shown as Min or Max, use the appropriate values per *Recommended Operating Conditions*.
2. Per TTL-driven control input. All other control inputs at GND. Switch I/O pins do not contribute to ΔICC.
3. This parameter represents the average DC current resulting from the switching of internal nodes of the device at a given frequency. The switch I/O pins make insignificant contribution to the dynamic power supply current of the device. This parameter is guaranteed, but not production tested.

Figure 3. VOLTAGE TRANSLATION

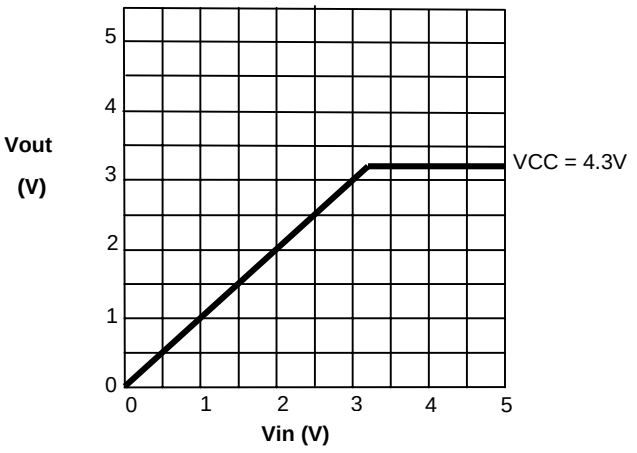

Figure 4. VOH CHARACTERISTICS

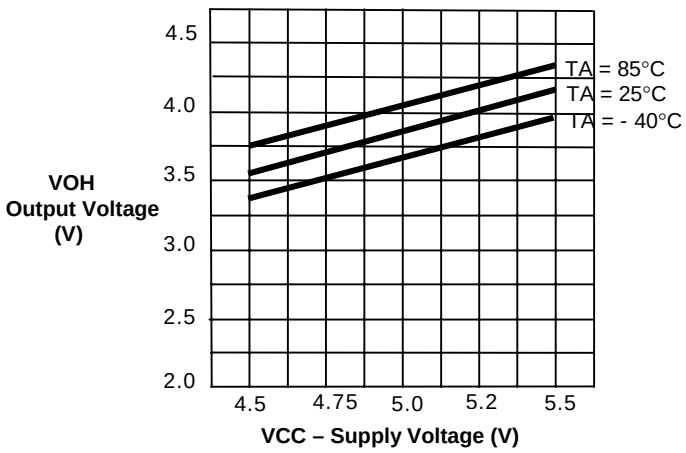

Figure 5. Voltage Translation Application

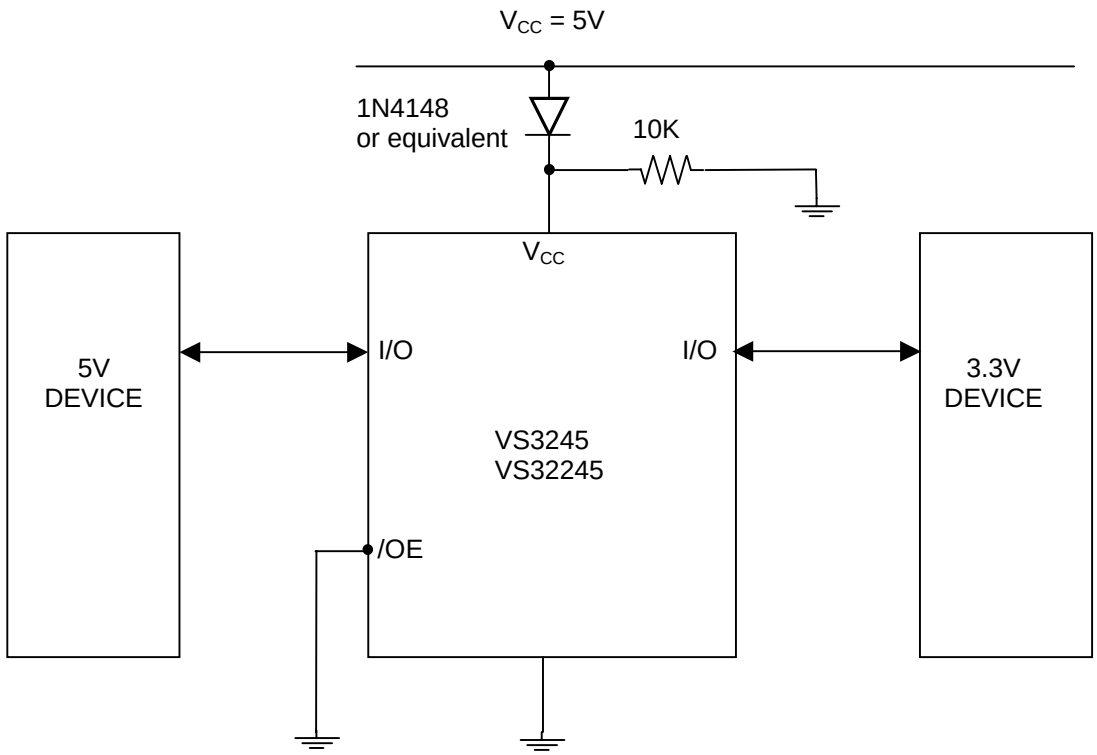

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Table 8. Switching Characteristics Over Operating Range

T_A = -40°C to +85°C, V_{CC} = 5.0V ± 10%
C_{LOAD} = 50pF, R_{LOAD} = 500Ω unless otherwise stated.

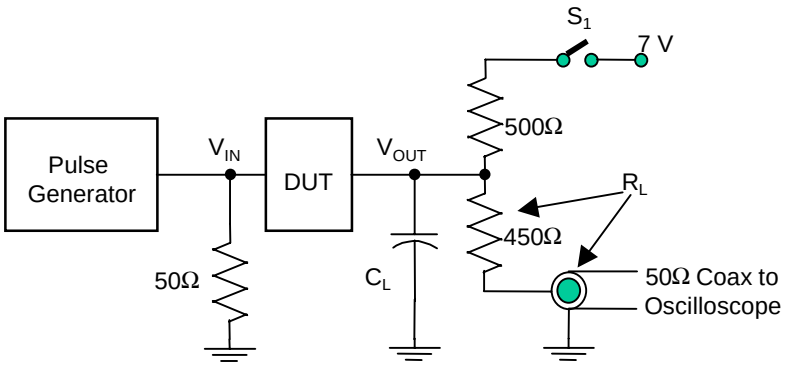
Symbol	Description [1]	VS3245 Min[3]	VS3245 Max	VS32245 Min[3]	VS32245 Max	Units
t_{PLH}, t_{PHL}	Data Propagation Delay [2,3] through the switch		0.25		1.25	ns
t_{PZH}, t_{PZL}	Switch Turn-on Delay, /OE to A_n, B_n	0.5	5.6	0.5	6.6	ns
t_{PLZ}, t_{PHZ}	Switch Turn-off Delay /OE to A_n, B_n	0.5	4.5	0.5	4.5	ns

Notes:

1. See test circuits and waveforms.
2. This parameter is the calculated theoretical RC time constant of ON-state resistance of the switch and the specified load capacitance when driven by an ideal voltage source (zero source impedance). This time-constant is on the order of 0.25 ns for VS3245 and 1.25 ns for VS32245. Since this time-constant is much smaller than rise/fall times of typical driving signals, it adds very little propagation delay to the system.
3. This parameter is guaranteed, but not production tested.

Figure 6. AC Test Circuit and Switching Waveforms

AC Test Circuit



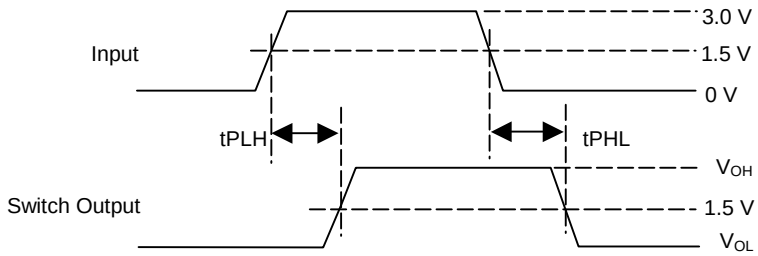
Load Switch Position

TEST	S1
t_{PLH}, t_{PHL}	Open
t_{PLZ}, t_{PZL}	Closed
t_{PHZ}, t_{PZH}	Open

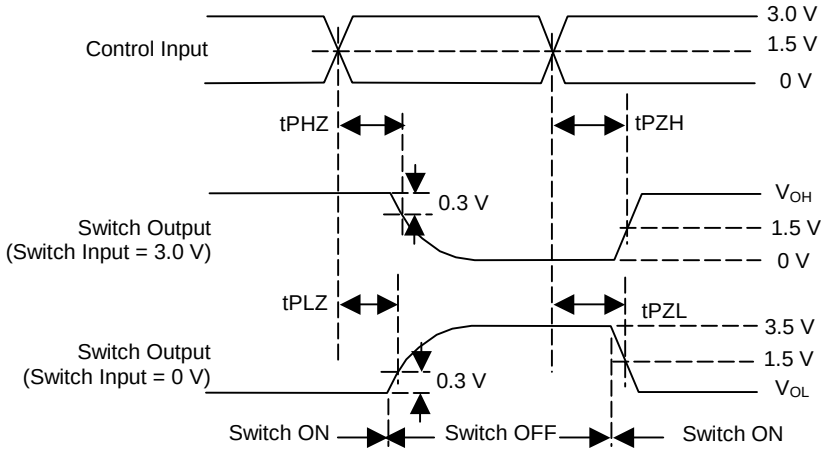
Input Conditions

Input voltage = 0 V to 3.0 V
t_r = t_f = 2.5ns (10% to 90%)

Switching Waveforms



Propagation Delay



Enable and Disable Times

Ordering Information

Part Number	Marking	Shipping/Packaging	No. of Pins	Package	Temperature
VS3245Q	VS3245Q	Tubes	20	QSOP	-40°C to +85°C
VS3245QX	VS3245Q	Tape & Reel	20	QSOP	-40°C to +85°C
VS32245Q	VS32245Q	Tubes	20	QSOP	-40°C to +85°C
VS32245QX	VS32245Q	Tape & Reel	20	QSOP	-40°C to +85°C